

Name: _____ Date: _____ Period: _____

Coulomb's Law Analysis

LEARNING OBJECTIVE

Learn what variables affect the forces of attraction and repulsion for particles.



PART 1: INTRODUCTION

1. Is it easier to take the ball away from a player if they're holding the ball **close to them** or **far away**? Why?

2. Is it easier to take a football away from a **big, strong player** or a **weak, scrawny player**? Why?

PART 2: SIGN OF CHARGE

3. What will two particles that are both positive do to each other?

4. What will two particles that are both negative do to each other?

5. What will two particles that have opposite charges do to each other?

6. What will two particles do to each other if either of them are neutral/0 charge?

7. Which particle within the atom is positive?

8. Which particle within the atom is negative?

9. What type of interaction do protons within the nucleus have with each other?

10. What type of interaction do protons and neutrons have with each other?

11. What type of interaction do electrons on the orbits have with each other?

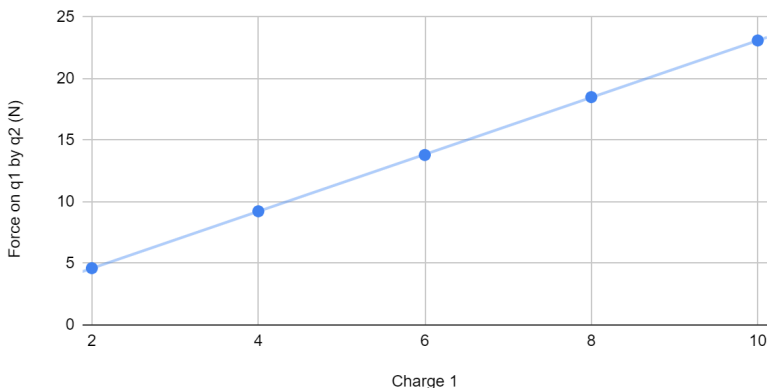
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12. What type of interaction do protons and electrons have with each other?

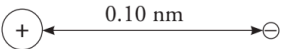
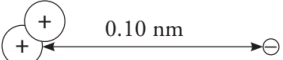
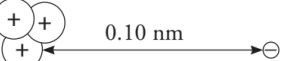
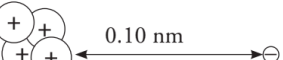
PART 3: MAGNITUDE OF CHARGE

Force on q1 by q2 (N) vs. Charge 1 (e)



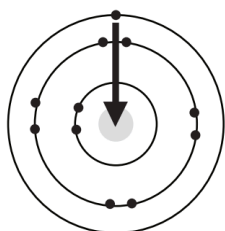
13. What is the relationship between the magnitude of charge, and the force on particles? (Direct, inverse, no change/constant, proportional, exponential, etc.)

Model 1 - Number of Protons and Attractive Force

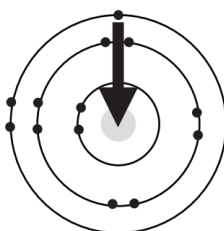
	Force of Attraction (Newtons)
<p>A </p>	2.30×10^{-8}
<p>D </p>	4.60×10^{-8}
<p>E </p>	6.90×10^{-8}
<p>F </p>	9.20×10^{-8}

14. What would be the attractive force on a single electron if five protons were in the nucleus of an atom? Show mathematical work to support your answer.

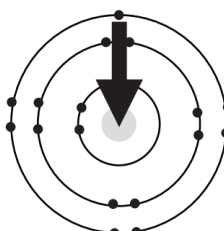
Model 2 - Period 3 Elements



Sodium



Aluminum



Chlorine



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15. Using your periodic table, locate the elements whose atoms are diagrammed in Model 2. Are the elements in the same group/column or the same period/row?

16. **LABEL** the number of protons within the nucleus of each atom.
17. **CIRCLE** the outermost electron(s) in each of the atoms in Model 2. The outermost electrons are referred to as **valence electrons**, while the electrons on all rings not on the outermost ring are referred to as **core electrons**.
18. Which of the three atoms diagrammed in Model 2 has the strongest attraction for its outermost electron(s)?

Consider the information in Model 2.

19. As you move from the smallest atom to the largest atom, does the distance between the outermost electron(s) and the nucleus change significantly?

20. Can the difference in the attractive force shown by the arrows be explained by a change in the distance between the electron(s) and the nucleus?

21. Can the difference in attractive forces shown by the arrows in Model 2 be explained by a change in the number of protons in the nucleus? If yes, explain the relationship in Model 2.

22. As you move from left to right across a period/row, what happens to the strength of attraction between protons and outermost/valence electrons in an atom?

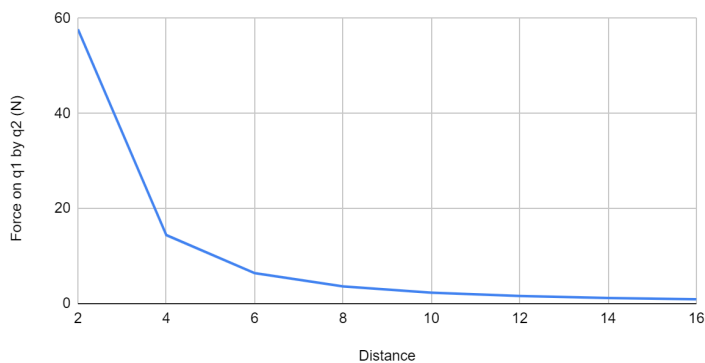
23. Circle the element whose atoms will have a **stronger** attractive force between their outermost electron(s) and the nucleus.

A. Cr or Cu

B. F or Li

PART 4: DISTANCE BETWEEN CHARGES

Force on q1 by q2 (N) vs. Distance (pm)



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24. What is the relationship between the distance between particles, and the force on particles? (Direct, inverse, no change/constant, proportional, exponential, etc.)

Model 1 - Distance and Attractive Force

		Force of Attraction (Newtons)
A		2.30×10^{-8}
B		0.58×10^{-8}
C		0.26×10^{-8}

25. What subatomic particles do these symbols represent in Model 1? (i.e Protons, Neutrons, Electrons)



26. If the distance between a proton and electron is 0.50 nm, would you expect the force of attraction to be greater than or less than 0.26×10^{-8} N?

27. If **two** protons are 0.10 nm away from one electron, would you expect the force of attraction to be greater than or less than 2.30×10^{-8} N?

Consider the diagrams in Model 2.

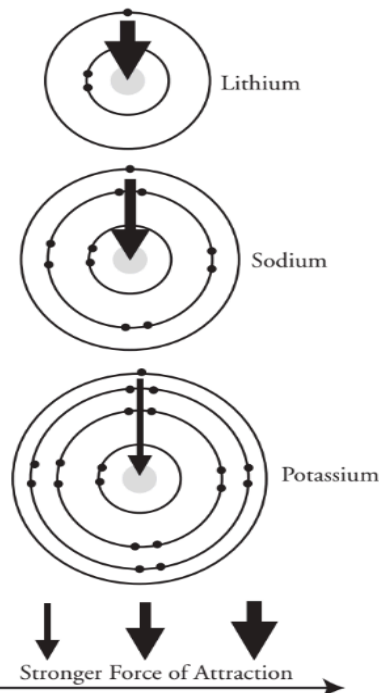
28. What do the arrows represent?

29. How does the thickness of the arrows relate to the attraction?

30. Using a periodic table, locate the elements whose atoms are diagrammed in Model 2. Are the elements in the same group/column or same period/row?

31. Does the number of rings around each atom equal the group number or period number?

Model 2 - The Alkali Metals



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32. On each diagram **WRITE** the number of protons in the nucleus of the atom.
33. **CIRCLE** the outermost electron in each of the diagrams in Model 2.
34. As you move from the smallest atom to the largest atom in Model 2, how does the distance between the outermost electron and the nucleus change?

35. As you move from the smallest atom to the largest atom in Model 2, how does the attractive force between the outermost electron and the nucleus change?

36. For each set of elements below, circle the element whose atoms will have a **stronger** attractive force between their outermost electron(s) and the nucleus.

A. Ba or Ca

B. F or Br

PART 5: SUMMARY

37. When comparing elements in the same group/column of the periodic table, which factor - distance to the nucleus or number of protons in the nucleus - seems to be the dominant factor for determining the attractive force between the outermost electron(s) and the nucleus? Explain.

38. As you move from left to right across a period on the periodic table, what pattern/trend exists for the strength of attraction between the nucleus and the outermost/valence electrons in an atom?

39. As you move from down from top to bottom in a group on the periodic table, what pattern/trend exists for the strength of attraction between the nucleus and the outermost/valence electrons in an atom?

40. In which area of the periodic table would you find the atom with the **strongest** attraction between its nucleus and its outermost/valence electrons?

41. In which area of the periodic table would you find the atom with the **weakest** attraction between its nucleus and its outermost/valence electrons?